Case Report

Challenges in Anaesthetic management of a child for thoracoscopic assisted oesophageal replacement

Address for correspondence:
Dr. KR Chandrakala, Shrinidhi, No. 805/i, 15th Cross, Kanakapura Road, Jayanagara 7th Block (West), Bengaluru - 560 070, Karnataka, India.
E-mail: chandrakalakr@yahoo.com

Access this article online

Website: www.ijaweb.org

DOI: 10.4103/0019-5049.176269

Quick response code

KR Chandrakala, Bindu Nagaraj, DV Bhagya, YR Chandrika

Department of Paediatric Anaesthesia, Indira Gandhi Institute of Child Health, Bengaluru, Karnataka, India

ABSTRACT

The loss of oesophageal length or obliteration of oesophageal lumen due to stricture acquired by accidental caustic ingestion is more common in children that may require major operative reconstruction. A number of procedures have been developed for anatomic replacement of oesophagus of which thoracoscopic assisted gastric transposition has shown the best outcome in children. This demands an extensive pre-operative evaluation, preparation and anaesthetic management since this is challenging and prolonged procedure done under one lung ventilation (OLV). Though it is a minimally invasive procedure, providing OLV and management of complications associated with it are the anaesthetic challenges among these children. We report anaesthetic management of an 8-year-old boy with oesophageal stricture following corrosive injury posted for thoracoscopic assisted gastric transposition.

Key words: Anesthesia, oesophageal replacement, pediatric thoracoscopy, video-assisted thoracoscopic surgery

INTRODUCTION

Corrosive alimentary tract injuries are a source of considerable morbidity all over the world. The burden of this condition is more common in children, especially in developing countries such as India because of poor regulation of the sale of corrosive substances, negligence and low socio-economic status.[1] The statistical report from the USA for 2008 documents an incidence of 191,397 cases of corrosive injuries. Of these, 62.9% were in children and 92.5% were in accidental. Such data are not available in India due to under-reporting.[2]

Gastric transposition obviates the need for thoracoscopy-assisted gastric transposition, preventing redundancy and lung compromise requiring a single cervical anastomosis.[3] This is found to be associated with excellent long-term outcome and patient satisfaction. The expanding role of thoracoscopy and video-assisted thoracoscopic surgery in the paediatric population requires one lung ventilation (OLV), which provides improved exposure of the surgical field and possibly a diversion of ventilation from the damaged airway or lung. It requires manipulation of the airways along with significant physiological changes and potential hypoxemia. The complexity of the challenge of OLV increases with paediatric patients because of the rarity of this procedure, decreased airway size and limited techniques available. Options for lung isolation are limited in infants because endobronchial and univent tubes are too large for smaller children.[4]

CASE REPORT

An 8-year-old boy weighing 15 kg with a history of accidental caustic ingestion 2 years ago with severe oesophageal stricture was posted for oesophageal replacement. The child had undergone upper gastrointestinal endoscopy and oesophageal dilatation several times under general anaesthesia. In spite of several attempts of dilatation, the difficulty in swallowing saliva persisted and an oesophageal

How to cite this article: Chandrakala KR, Nagaraj B, Bhagya DV, Chandrika YR. Challenges in Anaesthetic management of a child for thoracoscopic assisted oesophageal replacement. Indian J Anaesth 2016;60:127-30.

replacement was planned. Being a radical procedure, the patient underwent gastrostomy to improve his nutrition. Six months later, he was posted for gastric pull up.

After pre-anaesthetic examination, informed consent was taken, standard fasting guidelines, blood and blood components were ordered. Adequate hydration was achieved with a good intravenous access given the night before. The child was pre-medicated with intravenous midazolam 0.75 mg in the holding area. Upon arrival in the operating theatre, under standard anaesthesia monitoring (electrocardiogram, peripheral oxygen saturation, non-invasive blood pressure, capnography) and with pre-oxygenation, the child was induced with intravenous thiopentone sodium 5 mg/kg, fentanyl 2 μg/kg, morphine 0.1 mg/kg and atracurium 0.5 mg/kg and left main bronchus was intubated with number 4.5 uncuffed single lumen endotracheal tube (ETT). Uncuffed ETT was used for one lung ventilation (OLV) because of the non-availability of OLV airway devices. The distal end of the ETT was modified to an S-shaped curve with the help of stillete. After passing through the vocal cord, the tube was rotated 180° to the left and head turned right. The tube was then inserted 2 cm (2 markings) into the trachea to achieve left endobronchial intubation and left lung ventilation was confirmed by auscultation. The right radial artery was then cannulated for continuous blood pressure monitoring and blood sampling. Two peripheral intravenous access were also secured in lower limbs with 20 gauge cannulae. The child was then positioned in left lateral position for thoracoscopy. The thoracoscopy was performed with an intrathoracic pressure of 8 mmHg at a flow rate of 1 l/h. The patient was ventilated using a mixture of oxygen and air with a tidal volume of 6 ml/kg, respiratory rate of 30/min and positive end-expiratory pressure (PEEP) of 5 cm H_2O. Peak inspiratory pressure was maintained between 20 and 25 cm H_2O using close circuit. Anaesthesia was maintained with isoflurane and atracurium infusion (0.5 mg/kg/h). The patient had repeated episodes of desaturation and one episode of bradycardia during initial 15 min of thoracoscopy assisted oesophageal mobilisation. This was treated by increasing FiO_2 intravenous atropine 0.02 mg/kg and by reducing intra-thoracic pressure (capnopressure) to 5 mmHg. Transient episodes of desaturation, disappearance of capnography and pulse wave were noticed during the separation of oesophagus from trachea due to tracheal handling. Adequate ventilation was difficult to maintain, and thus OLV was converted to two lung ventilation. Regular blood gas analysis guided us to maintain adequate ventilation intraoperatively. After complete oesophageal mobilisation, the child was repositioned (supine) and gastric transposition with cervical anastomosis was performed (open technique). Feeding jejunostomy was performed to maintain the post-operative nutrition. Intra-operative period was otherwise uneventful.

Thoracic epidural catheter was placed postoperatively at the level of T4 and T5, and threaded 3 cm from the point of insertion, caudally to provide lower thoracic and upper abdominal post-operative analgesia with continuous infusion of 0.2 ml/kg of 0.125% bupivacaine. Intra-operative urine output and temperature were monitored. In view of an extensive procedure and anticipated post-operative respiratory and mediastinal complications, the child was electively ventilated for 3 days, and was weaned off.

DISCUSSION

Oesophageal substitution is the most common procedure planned for children with corrosive stricture of oesophagus. Performing this procedure by minimally invasive technique appears to be a promising approach to offer these children an acceptable quality of life.[5] On the other, anaesthesia for paediatric thoracoscopy needs experience in various techniques of providing OLV and utmost vigilance to detect intra-operative complications such as arrhythmias, hypoxia, hypercarbia and atelectasis that needs early detection and appropriate treatment.[5] Hypoxia and hypercarbia are more common in infants and younger children because of ventilation perfusion mismatch. In lateral decubitus position, dependent lung is less ventilated because of compression, more compliant rib cage and reduced functional residual capacity.[6] Post-operative complications include residual or recurrent pneumothorax, mediastinitis, increased secretions and pneumonia.[5]

The goals of anaesthesia for thoracoscopy are to minimise airway reactivity, optimise gas exchange, maintain stable cardiovascular function and prevent ventilator depression postoperatively.[7,8] This was achieved by meticulous monitoring of arterial blood pressure and central venous pressure as blood loss is not predictable in thoracoscopy. Arterial line placement for blood gas analysis is recommended because gas exchange may not always

be adequate because of falsely low reading by the capnograph.[4] Conventional ventilator settings frequently result in hypercarbia, and capnography is not reliable in detecting hypercarbia.

The disappearance of pulse wave and capnograph were observed, but arterial waveform continued to be stable which indicates the haemodynamic stability in our case. Thus arterial line placement is mandatory for blood gas analysis, to correct pH derangement, to assess haemodynamic stability, electrolyte imbalance correction.

As hypothermia is a major complication in thoracoscopic surgeries due to cold CO_2 gas inflation, temperature monitoring was done with a nasopharyngeal temperature probe, and there was mild hypothermia which was corrected by warming the patient.

Blood loss was estimated to be 150 ml, and 200 ml packed red blood cells and 150 ml of fresh plasma were administered intraoperatively.

We ventilated child's dependent lung (left lung) with oxygen and air, (OLV) with low tidal volume, low inspiratory pressure, high respiratory rate and PEEP. In spite of this, the child had repeated episodes of desaturation and bradycardia intraoperatively, and hence, we considered ventilating both the lungs. These episodes may be due to inadequate sealing of left main bronchus (uncuffed ETT) and prevents the other lung from adequately collapsing. To achieve adequate working space, surgeons increased the intra-thoracic pressure, and this resulted in hypoxia and subsequent bradycardia. Bradycardia may also be due to CO_2 gas insufflation which activates pulmonary stretch receptors and increases the vagal tone.[9] In view of 6 h of extensive surgery and anticipated pulmonary complications, we electively ventilated the child for 3 days and extubated. The recovery was adequate. The expanding role of video-assisted thoracoscopic procedures in the paediatric population requires OLV. The OLV provides improved exposure of the surgical field, diversion of ventilation from the damaged airways or lung.[4] The complexity of OLV increases in paediatric patients because of rarity of the procedures decreased airway size and limited techniques available. The options for lung isolation are limited in infants because endobronchial uninvent tubes are too large for small children. Therefore, it is necessary to use a device that can ventilate both lungs in the event of hypoxia and provide efficient lung isolation intraoperatively.[10] Uncuffed ETT was used for OLV because of non-availability of OLV airway devices. The distal end of the ETT was modified to an S-shaped curve with the help of stillete. After passing through the vocal cord, the tube was rotated 180° to the left and head turned right. The tube was then inserted 2 cm (2 markings) into the trachea to achieve left endobronchial intubation, and left lung ventilation was confirmed by auscultation.

This technique is simple and requires no special equipment other than fiberoptic bronchoscopy. Problems can occur when using single lumen ETT for SLV if a smaller and uncuffed tube is used. It may be difficult to provide an adequate seal of the intended bronchus. This may prevent the operative lung from adequately collapsing or may fail to protect the healthy ventilated lung from contamination by purulent and blood from the contralateral lung. Hypoxia may occur due to obstruction of the upper lobe bronchus, especially if the short right main bronchus is intubated.

CONCLUSION

A thorough knowledge about OLV and its associated complications to detect untoward events and treat them at the earliest is essential during thoracoscopic procedures. It is prudent to use a device which is user-friendly, appropriate to the child's age and weight, equipped with safety features that can ventilate both lungs in the event of hypoxia and provide efficient lung isolation. Good communication between the anaesthesiologist and the surgical team contributes to a safe and successful surgery.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Cowles RA, Coran AG. Gastric transposition in infants and children. Pediatr Surg Int 2010;26:1129-34.
2. Lakshmi CP, Vijayahari R, Kate V, Ananthakrishnan N. A hospital-based epidemiological study of corrosive alimentary injuries with particular reference to the Indian experience. Natl Med J India 2013;26:31-6.
3. Kandpal DK, Prasad A, Chowdhary SK. Laparoscopic and thoracoscopic gastric pull-up for pure esophageal atresia in early infancy. J Indian Assoc Pediatr Surg 2013;18:27-30.
4. Sutton CJ, Naguib A, Puri S, Sprenker CJ, Camporesi EM. One-lung ventilation in infants and small children: Blood gas values. J Anesth 2012;26:670-4.
5. Dave N, Fernandes S. Anaesthetic implications of paediatric thoracoscopy: Review article. J Minim Access Surg 2005;1:8-13.

6. Byon HJ, Lee JW, Kim JK, Kim JT, Tae Kim Y, Kim HS, *et al.* Anaesthetic management of VATS in pediatric patients, the issue of safety in infants and younger children. Korean J Anesthesiol 2010;59:99-102.
7. Chatterjee D. Anesthesia for Thoracoscopic Repair of Esophageal Atresia and Tracheoesophageal Fistula in a Neonate. MedEdPORTAL Publications; 2013.
8. Tobias JD. Anaesthetic implications of thoracoscopic surgery in children. Paediatr Anaesth 1999;9:103-10.
9. Dave N, Fernandes S. Anaesthetic implications of paediatric thoracoscopy. J Minim Access Surg 2005;1:8-14.
10. Fabila TS, Menghraj SJ. One lung ventilation strategies for infants and children undergoing video assisted thoracoscopic surgery. Indian J Anaesth 2013;57:339-44.

Announcement

Conference Calender - 2016

Name of the conference: 64th Annual National Conference of the Indian Society of Anaesthesiologists, ISACON 2016
Date: 25th to 29th November 2016
Venue: Punjab Agricultural University, Ludhiana
Organising Secretary: Dr. Sunil Katyal
Contact: +91 98140 30552
E-mail: katyalsunilmd@gmail.com
Website: www.isacon2016.com

Name of the conference: ISACON SOUTH – 2016 & ISACON Karnataka - 2016
22nd Annual South Zone Conference of ISA
Date: 19th to 21st August 2016
Venue: KLE Centenary Convention Center, J N Medical College Campus, Nehru Nagar, Belagavi
Organising Secretary: Dr. Manjunath C. Patil
Contact: +91 97431 10637
E-mail: isaconsouth2016@gmail.com
Website: www.isaconsz2016.in

Name of the conference: ISACON GUJARAT – 2016 & WIZACON 2016
49th Annual State Conference of ISA GUJARAT State Chapter & 12th West Zone Conference
Date: 23rd to 25th September 2016
Venue: Rangoli Hotel & Resorts, Vertej, Bhavnagar
Organising Secretary: Dr. Fremiot J. Mascarenhas
Contact: +91 94284 01780
E-mail: drfremiot@hotmail.com / isacongujarat2016@gmail.com
Website: www.isacongujarat2016.com

Name of the conference: ISACON EAST – 2016
Annual East Zone Conference of ISA
Date: 9th to 11th September 2016
Venue: Puri, Odisha
Organising Secretary: Dr. Debaprasad Mohanty
Contact: +91 94370 21313
E-mail: drdev07@yahoo.com

Name of the conference: ISACON NORTH EAST 2016
4th North East Zone Conference of ISA
Date: 22nd to 23rd October 2016
Venue: Assam Medical College, Dibrugarh
Organising Secretary: Dr. Dhrubajyoti Borgohain
Contact: +91 94350 31489
E-mail: dhruba_borgohain@yahoo.co.in

Name of the conference: ISACON KERALA – 2016
40th Annual State Conference of ISA Kerala State Chapter
Date: 7th to 9th October 2016
Venue: MAC FAST Auditorium, Tiruvalla
Organising Secretary: Dr. Koshy Thomas
Contact: +91 94473 98170
E-mail: thomaskoshy59@gmail.com

Name of the conference: ISACON RAJASTHAN – 2016
18th Annual State Conference of ISA RAJASTHAN State Chapter
Date: 7th to 9th October 2016
Venue: Government Medical College Auditorium, Kota
Organising Secretary: Dr. Mukesh Somvanshi
Contact: +91 94142 86314
E-mail: isaconraj2016@gmail.com
Website: www.isaconrajasthan2016.com

Name of the conference: ISACON MAHARASHTRA – 2016 (MISACON 2016)
Bi Annual State Conference of ISA MAHARASHTRA State Chapter
Date: 14th to 16th October 2016
Venue: M G M Medical College Aurangabad
Organising Secretary: Dr. Balaji Asegaonkar
Contact: +91 93250 78733
E-mail: b_asegaonkar@yahoo.com / misacon2016@yahoo.com
Website: www.misacon2016.com

Name of the conference: ISACON TELANGANA – 2016
2nd Annual State Conference of ISA Telangana State Chapter
Date: 27th to 31st July 2016
Venue: Govt. Medical College & Teaching Hospital, Nizamabad
Organising Secretary: Dr. Chintala Kishan
Contact: +91 98480 71377 & 99490 46637
E-mail: isacontelangana2016@gmail.com, chintala_kishan@yahoo.in
Website: www.isatelangana.org

Name of the conference: ISACON MP - 2016
30th Annual State Conference of ISA MP State Chapter
Date: 10th September 2016
Venue: Hotel Jabali Palace, Jabalpur
Organising Secretary: Dr. Ashish Sethi
Contact: +91 98261 68747
E-mail: ashsethi64@yahoo.com
Website: http://www.isampchapter.com

Name of the conference: 4th World Congress of Ophthalmic Anaesthesia (WCOA), 2016
Organized by: Sankara Nethralaya and British Ophthalmic Anaesthesia Society
Date: 3rd & 4th September, 2016
Venue: ITC Grand Chola, Chennai
Organising Secretary: Dr. Jaichandran V V
Contact: +91 98840 96860
E-mail: wcoa2016@gmail.com
Website: www.sankaranethralaya.org/wcoa2016
